

REMARKS

This application has been carefully reconsidered in view of the Office Action of September 19, 2005. By this amendment, independent claims 1, 23 and 31 have been amended to specifically require that hydrogen be added to the olefin-rich feedstock prior to supplying the feedstock to the reaction zone containing the crystalline silicate catalyst in order to provide the contact of the catalyst with the feedstock in the presence of hydrogen. Support for this amendment is found in applicants' specification, for example, in page 9, lines 19 *et seq.* and page 21, lines 11 *et seq.* Thus, all of the claims are now directed to the preferred embodiment of applicants' invention in which the hydrogen is supplied to the reaction zone by incorporating the hydrogen into the feedstock prior to introduction of the feedstock into the reaction zone. As discussed below, the patent to Haag does not disclose the cracking of an olefin-rich feedstock in the presence of hydrogen to enhance the stability of the catalyst as involved in applicants' invention. Further, the reference in Haag to hydrocracking does not import into Haag a disclosure of the cracking of olefins in the presence of hydrogen for any reaction. However, even if one were to assume the contrary, it is evident that there is no disclosure in Haag of introducing hydrogen into an olefin-rich feedstock prior to contact of an olefin-rich feedstock with the catalyst. The hydrocracking referred to in Haag would not involve an olefin-rich feedstock of any character, but even if the contrary were to be assumed, there would be no reason following the teachings of Haag to introduce hydrogen into the feedstock prior to supply of the feedstock to the reaction zone and into contact with the catalyst.

Assuming that the Haag process were to involve the introduction of hydrogen into the reaction zone, as acknowledged in the Office Action Haag is silent as to how the hydrogen is added to the reaction zone. If we are to assume that the Haag process involves the addition of hydrogen to the reaction zone containing an olefin-rich feedstock, and this is not found in the

Haag reference itself but only in the analysis by the Examiner of what Haag means by the hydrocracking of petroleum products, there is no teaching in Haag of adding the hydrogen to the feedstock prior to supplying the feedstock to the reaction zone.

Common to the rejection of all of the claims in this case, whether based upon Haag or Haag in view of Colombo, is the Examiner's position that the reference in Haag to "hydrocracking" involves the cracking of olefins in the presence of hydrogen. Applicants would respectfully submit that the Examiner is in error in this position. Haag is directed to a process for contacting a zeolite catalyst with water in order to enhance its activity. As disclosed in Haag in the abstract and at pages 21-24, the enhanced activity zeolites can be employed in hydrocarbon conversion processes including cracking, hydrocracking, alkylation, dealkylation, transalkylation, isomerization, dimerization, oligomerization, polymerization, disproportionation, and aromatization. Haag does not disclose the cracking of an olefin-rich feedstock in the presence of hydrogen to produce a lower molecular weight effluent while enhancing the stability of the catalyst. Recognizing this deficiency in Haag, the rejection relies upon the disclosure in Haag of "hydrocracking" as amounting to a disclosure of the cracking of olefins in the presence of hydrogen. This is totally inconsistent with what one of ordinary skill in the art would understand to be a hydrocracking process. The term "hydrocracking" is commonly understood to be the cracking of petroleum or petroleum products in the presence of hydrogen. Attention in this regard is respectfully invited to page 613 (hydrocracking) and to page 889 (petroleum) of *Hawley's Condensed Chemical Dictionary*, Twelfth Edition, Van Nostrand Reinhold Company, copies of which are attached. Petroleum and petroleum products do not involve material amounts of olefins but are understood by those skilled in the art to involve paraffinic and aromatic hydrocarbons. While olefins can be derived from petroleum fractions by refining operations, for example, by conversion of alkanes originally found in petroleum to alkenes, they

are not typically present in petroleum or petroleum fractions which are commonly understood to be the feedstock in a hydrocracking procedure. Moreover, even if minor amounts of olefins were to be involved, they would not normally be present in an amount of 10 wt.% or more. Thus, the reference in Haag to "hydrocracking" would not denote to one of ordinary skill in the art the cracking of an olefin-rich hydrocarbon feedstock containing 10-100 wt.% olefins as required in applicants' claims. It is again emphasized that hydrocracking processes, as they are understood by those skilled in the art, do not involve the cracking of an olefin-rich feedstock. Far from being rich in olefins, the feedstocks commonly employed in hydrocracking procedures typically involve feedstocks or petroleum fractions, which simply do not involve olefins, much less involving olefin-rich feedstocks having 10 wt.% or more of olefins.

Turning first to the rejection of claims 1-5, 12, 13, 16-25 and 30 as obvious over Haag, it will be noted that in the first instance Haag does not disclose the cracking of an olefin-rich feedstock in the presence of hydrogen and a zeolite catalyst to produce a lower molecular weight effluent. Further, Haag fails to disclose that the effluent and the product have olefin contents within the range of $\pm 15\%$ as recited in all of applicants' claims. To the extent that the rejection is based upon a presumption that these features or other features called for in applicants' claims are inherent in or must be found in Haag, applicants would respectfully submit that the Examiner has not established any basis for such a presumption. First of all, Haag, as noted above, discloses a wide variety of processes. While hydrogen may be present in some processes (generally Haag refers to hydrogen/hydrocarbon ratios varying from 0, *i.e.* no hydrogen, up to about 20), Haag does not disclose the use of hydrogen in conjunction with the cracking of olefins to lower molecular weight olefins. In fact, the only disclosure of the use of hydrogen in conjunction with olefins appears to be in conjunction with olefin polymerization (the first full

paragraph of page 22) or olefin or paraffin aromatization (the paragraph bridging pages 22 and 23). Other processes in which hydrogen may be present involve hydrocracking, isomerization, and disproportionation. These processes obviously do not involve the cracking of higher molecular weight olefins to lower molecular weight olefins. As noticed previously, the term "hydrocracking," as commonly used and as used in the Haag reference, does not involve in any fashion the cracking of an olefin-rich hydrocarbon feedstock in the presence of hydrogen. Further, there is nothing in Haag which would even remotely suggest the use of hydrogen to enhance the stability of the catalyst.

The Office Action is in error in its assertion in page 2 that Haag discloses cracking of an olefinic feedstock in the presence of hydrogen in the Abstract or in the material starting at page 20, line 22, through page 21, line 17. The first portion of this material, page 20, line 22, through page 21, line 11, is not concerned with an olefin cracking procedure. This paragraph appears generally to relate to acid-catalyzed hydrocarbon conversion processes. Beyond this, it is impossible to tell what conversion reactions are referred to here, but at least insofar as olefins are concerned, since the only reference in Haag to the use of hydrogen in connection with olefins is in polymerization or aromatization, it is clear that this material is not applicable to an olefin cracking process. The material in the next paragraph of Haag starting at page 21, line 12, refers to cracking activity in the conversion of a list of materials including olefins. However, hydrocracking or the use of hydrogen would not be involved here. This is evident from the following sentence in Haag which starts: "The activated catalysts produced by the instant invention may also be used in hydrocracking, alkylation . . ." (Emphasis added). Thus, Haag discloses here cracking which may involve a number of feedstocks including olefins and, separate from this, other processes including hydrocracking. As recognized in page 2 of the

Office Action, Haag does not disclose the olefin content of the feedstock as set forth in each of independent claims 1, 22 and 30. The comments found here as to what one of ordinary skill in the art would expect is simply not an issue. The issue under 35 U.S.C. § 103 is one of obviousness of the claimed subject matter to one of ordinary skill in the art. Such obviousness cannot be established by a mere assertion of obviousness. Similarly, obviousness cannot be established by a mere assertion that feedstocks containing any amount of olefins would yield similar results. There is simply no basis in the prior art or in the record in this application to support the Examiner's position taken here. A mere assertion of obviousness, without factual support in the prior art as to why the invention is considered to be obvious, is not sufficient to support a rejection under 35 U.S.C. §103. Thus, in *In re Cofer*, 148 USPQ 268 (CCPA 1966), the court stated at page 271:

“Necessarily it is facts – which must support the legal conclusion of obviousness under 35 U.S.C. § 103. Merely stating that a compound or composition is obvious, without adequate factual support, is not sufficient.”

Here, as in *In re Cofer*, the rejection based upon Haag amounts simply to a statement that the invention is obvious without giving facts other than those found in applicants' specification, in support of this conclusion.

The Examiner's attention is also respectfully invited to MPEP § 2143.01, which states in the third paragraph:

“Obvious can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art.”

Here, the only basis for modifying the reference to provide cracking of an olefin-rich feedstock containing from 10-100 wt.% olefins is found in applicants' specification and not in the prior art.

The material found in Haag at page 23, lines 5-26, refers to two different types of conversion, cracking in lines 5-15 and hydrocracking in lines 15-26. As noted previously, hydrocracking is carried out with respect to petroleum fractions involving saturated aliphatic compounds and aromatic compounds. Hydrocracking is not commonly understood to involve a reaction involving the cracking of olefin-rich feedstocks.

In regard to claims 2 and 3 and 23 and 24, applicants respectfully submit that the claimed hydrogen partial pressures cannot be found in Haag since, as noted above, Haag clearly does not disclose the use of hydrogen in an olefin cracking process. Hydrocracking is, of course one of many reactions disclosed in Haag, and as noted above, hydrocracking does not involve the cracking of an olefin-rich feedstock containing 10-100 wt.% olefins. With respect to the olefin partial pressures found in claims 18 and 19 or the temperatures found in claims 16 and 17, applicants would respectfully submit that the very broad ranges found in Haag, and even then not in respect of an olefin cracking process, do not anticipate or render obvious the very narrow ranges, such as the temperature range of 540-580°C set forth in claim 17. In regard to the disclosure in Haag of a range of about 400°F (204.4°C) to about 1000°F (537.7°C), it is noted that this range is further characterized as “preferably from about 500°F (260°C) to about 850°F (454.4°C). Both of the ranges disclosed in Haag are below applicants’ range, and the upper limit of this preferred range in Haag is far below the preferred range of 540-580°C involved in applicants’ process. Thus, Haag not only fails to anticipate or render obvious applicants’ range of 540-580°C, but also Haag actually teaches away from this range and the broader range of 500-600°C. With regard to this claim and other claims in which the Examiner takes the position that a very broad range found in the prior art would necessarily anticipate or render obvious a narrow

encompassed range called for in a claim, the Examiner's attention is respectfully invited to Section 2131.03 MPEP, Vol. 2, page 2100-80 (Rev. 3, 2005):

When the prior art discloses a range which touches, overlaps or is within the claimed range, but no specific examples falling within the claimed range are disclosed, a case by case determination must be made as to anticipation. In order to anticipate the claims, the claimed subject matter must be disclosed in the reference with "sufficient specificity to constitute an anticipation under the statute." What constitutes a "sufficient specificity" is fact dependent. If the claims are directed to a narrow range, the reference teaches a broad range, and there is evidence of unexpected results within the claimed narrow range, depending on the other facts of the case, it may be reasonable to conclude that the narrow range is not disclosed with "sufficient specificity" to constitute an anticipation of the claims. The unexpected results may also render the claims unobvious.

It would appear that the rejection fails to consider this practice as outlined in § 2131.03. Instead, the position taken in the Office Action simply involves a broad assertion of obviousness without any reasoning in support of this position.

In addition to the reasons advanced above, applicants would respectfully submit that dependent claims 5, 12, 13, and 21 recite additional limitations which further establish patentability of these claims over the patent to Haag. Claim 5 specifies that at least part of the hydrogen employed in the cracking process is recycled from the effluent produced in the cracking process. Clearly, there is nothing in Haag that would render obvious the recycle of hydrogen as specified in claim 5. With respect to claim 5 and also claims 12 and 13, applicants would respectfully submit that the issue of unobviousness must be determined by consideration of what is found in the prior art, and against this background, applicants would respectfully submit that a mere assertion of obviousness without factual support is not sufficient to support a rejection under 35 U.S.C. § 103. In this regard, attention is respectfully invited to the previous reference to *In re Cofer* and MPEP § 2143.0.

Necessarily it is facts . . . which must support the legal conclusion of obviousness under 35 U.S.C. § 103. Merely stating that a compound or composition is obvious, without adequate factual support, is not sufficient.

With respect to the last full paragraph of page 3 of the Office Action, applicants would respectfully submit that the issue presented under 35 U.S.C. § 103 is not one of optimization, but one of obviousness to one skilled in the art. As stated in MPEP § 2144.05II(B), under the heading, “Only Result-Effective Variables can be Optimized”:

A particular parameter must first be recognized as a result-effective variable, *i.e.*, a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation.

The simple fact is that there is nothing in the prior art references to support the proposition that only the routine experimentation of a prior art recognized result-effective variable is involved. Further, applicants would respectfully submit that the Examiner has provided no basis in the prior art for the position taken regarding the optimization of the cost of raw materials.

With respect to claim 21, as acknowledged on page 4 of the Office Action, Haag does not even address the subject of dienes. The fact that Haag fails to discuss the significance of the diene concentration of the feedstock does not in itself provide a basis for a finding that it would be obvious to remove dienes from such a feedstock. In any event, as is noted previously, Haag clearly is not at all concerned with the cracking of an olefin-rich feedstock in the presence of hydrogen.

Turning now to the rejection of claims 6-11, 14, 26-29, and 31-35 as unpatentable over Haag in view of Colombo, it is noted that the proposed combination of references, even if made exactly as proposed in the Office Action, does not cure the deficiency observed above with respect to the use of hydrogen. Colombo, like Haag, does not disclose the cracking of an olefin-

rich feedstock in the presence of hydrogen. In reference to claims 10 and 11, applicants would respectfully submit that the proposed combination of Haag and Colombo to arrive at the use of silicalite or a catalyst having a silicon/aluminum atomic ratio of at least 180 can be made only with the benefit of a hindsight after reviewing applicants' disclosure. It will be recalled that Haag discloses the use of a large number of ZSM zeolites which have relatively low silica/alumina mole ratios. Haag in pages 5 and 6 calls for the use of zeolites having a silica/alumina mole ratio of at least about 12 and specifies that it is preferred to use zeolites having higher ratios of at least about 30. Haag goes on to exemplify such higher silica/alumina ratios as being "about 70" (page 28, line 28, and page 32, line 24) and gives further examples, such as in Example 15 which can be calculated to be about 53. These are all silica/alumina mole ratio which, of course, must be divided by 2 to arrive at the silicon/aluminum atomic ratio. Thus, the highest ratio in terms of the silicon/aluminum ratio appears to be a calculated ratio of 35 as found in Examples 4 and 8. Against this teaching in Haag, applicants would respectfully submit that to replace the Haag zeolites with silicalite or other molecular sieves having a silicon/aluminum atomic ratio of at least 180 would be possible only in hindsight after a consideration of applicants' disclosure. One of ordinary skill in the art would not, viewing only the Haag and Colombo references, attempt to replace the zeolites in Haag which have appreciable aluminum contents with the silicalites in Colombo which have no aluminum content, *i.e.* a silicon/aluminum ratio of infinity.

With respect to claims 6-9 and 26-29, applicants note the comments found on page 5 of the Office Action that ethylene and other high olefins are present in the product of the Colombo patent. However, applicants' claims specify the addition of ethylene to the feedstock, and this clearly is not disclosed in either Haag or Colombo. In regard to the material found at page 3,

lines 28-30, of Colombo, this appears to be a negative teaching in Colombo. This paragraph starting on line 18 of page 3 and carrying over to page 4 actually involves the disclosure of a process incorporating an oligomerization step in order to avoid recycle of C₄ olefins unreacted or formed during the reaction. Further, applicants would respectfully note that such olefins would by no means necessarily include ethylene. In any case, there is nothing in the references which would render obvious the recycle of ethylene to the feedstock as required in claims 7 and 28. Further, the proposed combination of references would not lead one of ordinary skill in the art to the separation and recycle procedure of claim 28 involving, in addition, the recycling of C₅ olefins to the feedstock.

In regard to applicants' dependent claim 14 and also independent claim 31, it is noted that Colombo does not disclose a propylene yield on an olefin basis of 30-50% based on the olefin content of the feedstock. As shown in Fig. 1 of Colombo, the propylene is necessarily substantially less than 30% based upon the conversion data and the selectivity to propylene data presented in Fig. 1. To the extent that Table 4 of Colombo may be relied upon, the average propylene yield across the six examples reported there would appear to be well below a propylene yield on an olefin basis of 30%. If one of ordinary skill in the art were to attempt to modify the teachings of Haag to provide certain propylene yields based upon the data shown in Table 4, the results would be propylene yields less than 30%, similar to the data presented in Fig. 1 of Colombo. Further, applicants would respectfully submit that the question posed under 35 U.S.C. § 103 is not whether one of ordinary skill in the art could selectively pick out portions of the references in an attempt to combine them after reading applicants' disclosure. Instead, the issue is whether one of ordinary skill in the art would find the claimed process obvious in view of the prior art without the benefit of hindsight afforded by referring to applicants' disclosure.

In addition to the distinctions discussed above with respect to Haag or Haag combined with Colombo, applicants would respectfully refer to the following claims which, as discussed below, recite subject matter not rendered obvious in view of the prior art references.

Claim 25 further specifies that the olefin content of the effluent is $\pm 10\%$ of the olefin content of the feedstock. Claim 26 calls for the feedstock to contain olefins of 4 or more carbon atoms and, as discussed previously, further recites that ethylene is added to the feedstock prior to its introduction into the reaction zone. Claim 27 depends from claims 26 and specifies that a stream of C₅ or greater olefins are added to the feedstock prior to its introduction to the reaction zone.

Claim 28 is directed to the procedure shown in applicants' Fig. 5 and the attendant text at page 30, line 27, through page 31, lines 7, in which the effluent from the reaction zone is applied to a separation zone to recovery a light fraction of ethylene and a heavier fraction of C₃-C₅ olefins, with recycle of the ethylene and the C₅ olefins to the feedstock. Claim 29 depends from claim 28 and specifies that the ethylene recycled to the feedstock contains hydrogen. No matter what construction one might place on the Haag hydrocracking procedure, this subject matter is not found in or rendered obvious by the prior art. The reference in the Office Action to *In re Marsheck*, 168 USPQ 721 is noted. However, the decision there is obviously fact-intensive based upon the prior art involved in that case and has no applicability to the situation here.

Claims 31 and 32 depend from claim 30 and specify an MFI-type catalyst having a silicon/aluminum atomic ratio within the range of, respectively, 300-500 and 300-480. The prior art references, no matter how combined, would not result in the use of an MFI-type catalyst having a silicon/aluminum atomic ratio within the relatively narrow confines called for in these claims.

In view of the foregoing amendments and remarks, it is respectfully submitted that all of the claims in this application are patentable over the prior art. Accordingly, an early reconsideration and allowance of this application is respectfully requested.

This response is accompanied by a check in the amount of \$120, the fee for a one-month extension for response, thus extending the response deadline to January 19, 2006. The Commissioner is authorized to charge any additional fee required in connection with the submission of this document or credit any overpayment to the Locke Liddell & Sapp LLP deposit account no. 12-1781.

Respectfully submitted,



William D. Jackson
Registration No. 20,846

Date: January 19, 2006
Locke Liddell & Sapp LLP
2200 Ross Avenue, Suite 2200
Dallas, TX 75201-6776
Telephone: (214) 740-8535
Facsimile: (214) 756-8535